Bridging the menopause data gap: a scoping review of status, symptoms, and trends in electronic health records

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Abstract

Importance and Objective: Gaps in menopause status classification, reproductive stage documentation, and symptom capture (eg, vasomotor symptoms) within electronic clinical information systems, including electronic health records (EHRs), limit clinical care and menopause research. This scoping review examined how menopause-related data are structured and operationalized within EHR systems and identified gaps in documentation that limit clinical care and research.

Methods: We searched Ovid MEDLINE, Scopus, CINAHL, and IEEE Xplore (2004 to March 2026) using terms related to menopause, climacteric, perimenopause, and EHR documentation, supplemented by backward citation searching. Two reviewers independently screened studies, with discrepancies resolved by consensus. Quality appraisal was conducted using the Johns Hopkins Evidence-based Practice framework. Rayyan and Excel facilitated article management, data extraction, and synthesis.

Discussion and Conclusion: Nineteen studies met the inclusion criteria. Most were retrospective cohort or cross-sectional analyses conducted in US health systems (2013-2026), with sample sizes from 45 to 307,512 women. Thirteen studies relied on International Classification of Diseases, Ninth and Tenth Revisions (ICD-9/ICD-10) codes to identify menopause-related experiences; however, only nine reported the codes used. Across studies, three interrelated themes emerged: documentation limitations (including the absence of structured reproductive stage fields and reliance on unstructured text), undertreatment of documented symptoms, and underreporting of menopause-related symptoms in the EHR data. Menopause remains inconsistently represented in EHRs, reflecting structural documentation gaps that constrain longitudinal tracking, clinical decision-making, and research reproducibility. Development of standardized menopause common data elements, including structured stage and symptom documentation, will require coordinated, multidisciplinary efforts to improve data quality and support scalable menopause research.

Key Words: Data standards, Documentation practices, Electronic health record, Menopause, Women's health.

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Approximately 1.3 million women in the United States enter menopause transition each year, and by 2025, an estimated 1.1 billion women globally will be postmenopausal.[1] Menopause is a natural phase in a woman's life and typically occurs between the ages of 45 and 55, with the average age around 51 in the United

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States.[2,3] Natural menopause is defined as the permanent cessation of menses due to loss of ovarian follicular activity, determined retrospectively after 12 consecutive months of amenorrhea following the final menstrual period (FMP).[3,4] Menopause can also be defined as secondary to surgical or medical intervention. Although menopause is a normal life stage, it is associated with a wide range of symptoms and long-term health changes affecting cardiovascular, musculoskeletal, neurologic, and mental health systems. Common symptoms, including vasomotor symptoms, sleep disturbances, mood changes, musculoskeletal discomfort, and genitourinary symptoms, are frequently reported but may be inconsistently documented in clinical records.[1,3,5]

Accurate classification of reproductive aging is essential for both clinical care and research. The Stages of Reproductive Aging Workshop (STRAW+10) provided the most widely accepted staging system for reproductive aging, distinguishing premenopause, perimenopause (menopause transition), menopause, and postmenopause.[6] Standardized staging supports consistent identification of reproductive stage, symptom interpretation, and comparability across studies.[6,7] However, in routine clinical practice, menopause status and symptoms are often inferred from proxy indicators such as age ranges, diagnostic codes, or medication use rather than documented through structured staging approaches. Electronic health records (EHRs) offer significant potential to support longitudinal monitoring of menopause-related health, yet menopause data are frequently incomplete, inconsistently coded, or embedded in unstructured clinical notes data.[8,9]

Several validated symptom assessment tools exist, including the Menopause-Specific Quality of Life or Green Climacteric Scale, but these instruments are not routinely incorporated into structured EHR workflows or mapped to standardized clinical terminology.[10,11] Large cohort studies such as the Study of Women's Health Across the Nation or Seattle Midlife Women's Study have advanced understanding of menopause transition through standardized symptom measurement and longitudinal observation.[12-14] However, these research-grade measurements have not been widely translated into routine clinical documentation systems. As a result, menopause-related information in EHRs may be fragmented across providers and institutions, limiting longitudinal tracking, care coordination, and secondary use of clinical data for research.

Improving menopause documentation within EHR systems is therefore essential for advancing both clinical care and menopause science.[15,16] High-quality, structured data could support symptom recognition, treatment evaluation, and large-scale observational research, while also enabling more reliable data-driven approaches in health care.[13] However, best-practice guidance for how menopause status and symptoms are currently documented in EHRs remains limited.[17] As health care increasingly relies on data-driven approaches, including machine learning and artificial intelligence, inconsistent or unstructured menopause documentation in EHRs limits the reliability, scalability, and interoperability of menopause-related data.[9,18] Standardized data elements aligned with common data frameworks could improve cross-system data sharing, research, and clinical decision-making.[19,20]

OBJECTIVE

The objective of this scoping review was to examine how menopause status and symptoms are identified and represented in EHR-based studies and to synthesize current documentation practices, limitations, and opportunities for developing standardized menopause data elements.

METHODS

This review was conducted and reported in accordance with the Preferred Reporting Items for Systematic Reviews and Meta-Analyses extension for Scoping Reviews (PRISMA-ScR).[21] As this scoping review involved secondary analysis of published literature without primary data collection, institutional ethical approval was not required.

Search strategy and study selection

The search strategy was developed in consultation with a health sciences librarian and incorporated keyword and Medical Subject Heading terms related to menopause, climacteric, perimenopause, menopause transition, data elements, informatics, EHRs, and documentation. Searches were conducted in Ovid MEDLINE, Scopus, CINAHL, and IEEE Xplore using Boolean operators ("AND," "OR"). Studies published between January 2004 and March 2026 were eligible. This time frame was selected to reflect contemporary EHR adoption and documentation practices, including changes following the 2002 Women's Health Initiative findings and the widespread implementation of certified EHR systems beginning in 2009.[22,23] Inclusion criteria were as follows: (1) primary empirical studies evaluating menopause-related documentation, identification, or structured electronic data capture within clinical information systems; (2) focus on menopause status classification and/or menopause-related symptoms; (3) studies analyzing EHR-derived data or structured electronic platforms embedded within clinical workflows; and (4) English-language publications. Exclusion criteria included studies outside the specified time frame, studies not focused on menopause or not using EHR-related data, conference abstracts, non-peer-reviewed publications, reviews, news articles, and position statements. Two authors independently screened titles and abstracts, with disagreements resolved through discussion and consultation with a third author when needed. Reference lists of included articles were manually reviewed to identify additional relevant studies. During manuscript revision, newly published articles through March 2026 were screened for eligibility.

For this review, menopause data representation in the EHR refers to the data elements, variables, status

classifications, and methods used to capture and operationalize menopause-related information within clinical systems.

Data charting and analysis

We extracted and summarized key study characteristics, including geographic location, participant age range, study design, sample size, and setting (eg, hospital, outpatient clinic). Citations were imported into Rayyan for screening and management. No automated or AI-assisted inclusion decisions were used.[24,25] The first author extracted all data from full-text reviews and entered it into a spreadsheet (Excel v.2108) for analysis. During data extraction, studies were categorized by reproductive stage classification approach. Reproductive stage was classified as "self-reported" when participants explicitly identified menopausal status (eg, survey-based staging), "postmenopause" when defined by documented cessation of menses or menopause diagnosis, "age-based/unclear" when menopause status was inferred from age ranges without explicit staging criteria, and "not specified" when reproductive stage was not addressed in the study design or analysis.

Theme and subtheme identification

Using established knowledge synthesis methods, we developed themes and subthemes describing how menopause is represented and operationalized in EHRs to identify gaps and opportunities for improving data quality in clinical care and research.[21] Themes were inductively derived through iterative review of included studies. The first author conducted initial thematic coding, which was independently reviewed by a second author; discrepancies were resolved through consensus with a third author when needed. The thematic framework was refined as analysis progressed, and previously coded studies were re-evaluated to ensure consistency. To minimize bias, the fourth author was recused from final thematic decisions.

Operational definitions encompassed three primary themes: (1) documentation limitations, defined as missing, incomplete, or inconsistent menopause-related variables in the EHR, including reliance on unstructured notes, inconsistent terminology, or inability to distinguish menopause stage or status[13]; (2) undertreatment, defined as documentation of menopause-related symptoms without guideline-concordant management, including low use of hormone therapy (HT) or nonhormonal treatments and limited follow-up[8,26]; and (3) underreporting, defined as a discrepancy between expected or patient-reported symptom prevalence and what was documented in the EHR, or explicit attribution of missing data to factors such as nondisclosure, stigma, or lack of routine screening.[27,28]

Subthemes were identified by grouping recurring documentation patterns, analytic approaches, or reported limitations that reflected distinct mechanisms underlying each primary theme (eg, reliance on proxy indicators, use of unstructured data, or absence of standardized classification), with inclusion thresholds of two or more studies per subtheme. Studies were additionally categorized by whether they addressed menopause status, menopause symptoms, or both, and by the method used to identify menopause-related information (narrative description vs. structured EHR data elements). Each included study was assigned to a single primary theme based on its dominant analytic focus to ensure mutually exclusive categorization and prevent double-counting. Studies that reflected features of multiple themes were classified according to the primary objective. When available, supplemental data such as diagnostic codes (eg, International Classification of Diseases, Ninth and Tenth Revisions [ICD-9, ICD-10]) were extracted and summarized using descriptive statistics.[29] All thematic categories reflected synthesis-level interpretations of recurring documentation patterns reported across studies rather than labels consistently used by individual study authors.

Quality appraisal

To contextualize the strength of the included evidence, we applied the Johns Hopkins Evidence-Based Practice Model for Nursing and Healthcare Professionals (JHNEBP).[30] The JHNEBP model categorizes evidence into five levels: level I (experimental studies), level II (quasi-experimental studies), level III (nonexperimental or qualitative studies), level IV (expert opinion based on research evidence), and level V (nonresearch evidence, such as quality improvement reports or case studies). Study quality is further rated as high (A), good (B), or low (C) based on methodological rigor, consistency of findings, and sample characteristics. Consistent with scoping review methodology, quality appraisal was used to describe the nature and strength of the evidence base rather than to exclude studies.

RESULTS

Results are presented in three sections: (1) characteristics of included studies (Tables 1 and 2), (2) representation of menopause status and symptoms within EHR data (Table 3), and (3) thematic patterns reflecting documentation limitations, underreporting, and undertreatment (Table 4).

Characteristics of included studies

Nineteen studies met the inclusion criteria (Fig. 1).

Retrospective cross-sectional analysis was the most common study design. A majority of the included studies were conducted in the United States in hospital settings, with seven from the Veterans Health Administration (VA). The year of publication ranged from 2013 to 2026, sample sizes ranged from 45 to 307,512, and a majority of the included articles were at level III on the JHNEBP model (Table 1).

Most studies examined menopause symptoms (n = 16) and identified menopause using heterogeneous age-based criteria, diagnostic codes, or proxy indicators (Table 2). Only two studies explicitly classified participants as postmenopausal, whereas most relied on age-

TABLE 1. Study characteristics (sorted by year)

References	Country	Analytic sample (n)	Study design	Case definition (if applicable)	Strength level/ quality	Setting
Kleinman et al[31]	USA	17,322 women	Retrospective case control	Case = women with menopause-related ICD-9 diagnostic codes; Control = women without codes matched on demographics	III/B	Large US employer database
Malinowski et al[32]	USA	15,863 women	Algorithm validation study	Compared algorithm-identified menopause cases vs. chart review	III/B	Vanderbilt Medical Center
Sussman et al[33]	England	102 women	Retrospective	—	III/B	Reliant Medical Group
Vande Loo et al[34]	USA	70 women	Observational qualitative/ clinical	—	III/C	Mayo Clinic (multisite)
Sabanovic et al[35]	Croatia	202 women	Retrospective	—	III/B	General practice
Cordasco et al[36]	USA	5,250 women	Retrospective	—	III/B	VA
Gibson et al[37]	USA	104,984 women	Cross-sectional	—	III/B	VA
Gibson et al[38]	USA	200,901 women	Cross-sectional	—	III/B	VA
Gibson et al[39]	USA	70,864 women	Cross-sectional	—	III/B	VA
Lee et al[40]	Taiwan	74 women	Quasi-experimental, longitudinal analysis	—	II/C	Outpatient gynecology clinic
Ryu et al[41]	South Korea	3,298 women	Retrospective	—	III/B	Korea University Hospital
Blanken et al[42]	USA	200,901 women	Cross-sectional	—	III/B	VA
DePree et al[3]	USA	1,016 women	Retrospective	—	III/C	Multiprovider network
Pham et al[43]	Canada	2,776 women	Algorithm validation study	Case definition validation study to compare algorithm performance	III/B	Canadian Primary Care Sentinel Network
Bevry et al[8]	USA	229 women	Retrospective	—	III/B	Mayo Clinic Registry
Eyre et al[9]	USA	307,512 women	Retrospective NLP cohort	—	III/B	VA
Hogan et al[44]	USA	2,125 women	Retrospective case-only cohort	—	III/B	VA
Shourav et al[45]	USA	45 women	Retrospective	—	III/C	Mayo Clinic
Karam et al[46]	USA	2,414 women	Cross-sectional	—	III/B	Mayo Clinic

ICD, International Classification of Diseases; NLP, natural language processing; VA, Veterans Health Administration.

TABLE 2. Status, symptom, age range, and menopause identification in the electronic health record

References	Menopause (status/ symptoms)	Age (y)	Reproductive stage specified (peri/post/unclear)	How menopause was identified in the EHR data
Bevry et al[8]	Symptoms	45-60 (mean age 55.1)	Age-based/unclear	ICD diagnostic codes; SNOMED CT; age-based inclusion
Blanken et al[42]	Symptoms	45-64 (mean age 54.3)	Age-based/unclear	ICD diagnosis codes; pharmacy records (HT proxy); age-based inclusion
Cordasco et al[36]	Symptoms	40 and older (mean age 58)	Not specified	ICD codes for abnormal uterine bleeding (AUB); CPT codes for endometrial biopsy (EMB); age ≥40; HT prescriptions
DePree et al[3]	Symptoms	40-60 (mean age 52.9)	Age-based/unclear	Manual chart abstraction; symptom documentation in EHR; age-based inclusion
Eyre et al[9]	Status	65 and younger	Age-based/unclear	ICD diagnostic codes; SNOMED CT; NLP text extraction
Gibson et al[37]	Symptoms	45-64 (mean age 54.5)	Age-based/unclear	ICD diagnosis codes; pharmacy records; administrative EHR data; age-based inclusion
Gibson et al[38]	Symptoms	45-64 (mean age 54.3)	Age-based/unclear	ICD diagnosis codes; pharmacy records; administrative EHR data; age-based inclusion
Gibson et al[39]	Symptoms	55 and older (mean age 65.8)	Age-based/unclear	ICD diagnosis codes; pharmacy records; administrative EHR data; age-based inclusion
Hogan et al[44]	Status	35-65 (mean age 51.8)	Postmenopause	ICD diagnosis codes (first occurrence); age at diagnosis
Karam et al[46]	Symptoms	45-60 (mean age 54.2)	Self-reported (survey-based, not EHR structured)	Menopause Rating Scale (MRS) ≥12 + ICD diagnosis codes; self-reported reproductive stage, treatment use
Kleinman et al[31]	Symptoms	40 and older (mean age 51.0)	Age-based/unclear	Claims data; ICD diagnosis codes
Lee et al[40]	Symptoms	40-60 (mean age 50.9)	Age-based/unclear	Clinic-based electronic platform, not linked to EHR; age-based inclusion
Malinowski et al[32]	Status	≥41 y of age (mean age at menopause = 44.6)	Postmenopause	ICD diagnostic codes; CPT codes; NLP text extraction; structured reproductive milestone data
Pham et al[43]	Symptoms	45-60	Age-based/unclear	Repeated ICD diagnostic codes (case definition); pharmacy codes; age-based inclusion
Ryu et al[41]	Symptoms	40-80 (mean age 51.4)	Age-based/unclear	Patient-reported Menopause Rating Scale (MRS); linked clinical data
Sabanovic et al[35]	Status	47-59	Age-based/unclear	Hypertension cohort; age-based inference; no explicit menopause coding
Shourav et al[45]	Symptoms	≥45 (mean age 53.9)	Age-based/unclear	ICD diagnosis codes; age-based inclusion
Sussman et al[33]	Symptoms	45-65 (mean age 54)	Age-based/unclear	Hormone therapy prescription proxy; manual note abstraction
Vande Loo et al[34]	Symptoms	NA	Age-based/unclear	Patient questionnaire data; not EHR-derived

CPT, Current Procedural Terminology; EHR, electronic health record; HT, hormone therapy; ICD, International Classification of Diseases; NLP, natural language processing.

TABLE 3. Menopause International Classification Diagnostic codes

Clinical domain	ICD-9 codes	Studies using ICD-9	ICD-10 codes	Studies using ICD-10
Artificial/surgical menopause	627.4	Blanken et al[42]; Eyre et al[9]; Gibson et al[37]; Gibson et al[38]; Gibson et al[39]; Hogan et al[44]; Pham et al[43]	N95.3	Eyre et al[9]; Hogan et al[44]; Pham et al[43]; Karam et al[46]
Asymptomatic menopausal state	v49.81	Eyre et al[9]; Hogan et al[44]	Z78.0	Eyre et al[9]; Hogan et al[44]; Karam et al[46]
Asymptomatic postprocedural ovarian failure	—	—	E89.40	Karam et al[46]
Asymptomatic premature menopuase	—	—	E28.319	Eyre et al[9]; Hogan et al[44]; Karam et al[46]
Dyspareunia	625.x	Gibson et al[38]	—	—
Hormone therapy use	V07.4	Cordasco et al[36]; Gibson et al[39]	Z79.890	Eyre et al[9]; Hogan et al[44]; Karam et al[46]
Menopausal and postmenopausal disorders	627	Eyre et al[9]; Hogan et al[44]; Pham et al[43]	—	—
Other primary ovarian failure	—	—	E28.39	Karam et al[46]
Other specified menopause and perimenopausal disorders (including GMS)	—	—	M95.8	Karam et al[46]
Other specified menopause and postmenopausal disorders	627.8	Blanken et al[42]; Eyre et al[9]; Gibson et al[37]; Gibson et al[38]; Gibson et al[39]; Hogan et al[44]; Pham et al[43]	—	—
Ovarian dysfunction - other	256.8	Eyre et al[9]	—	—
Postablative ovarian failure	256.2	Eyre et al[9]	—	—
Postmenopausal atrophic vaginitis	627.3	Blanken et al[42]; Eyre et al[9]; Gibson et al[37]; Gibson et al[38]; Gibson et al[39]; Hogan et al[44]; Pham et al[43]	N95.2	Eyre et al[9]; Hogan et al[31]; Karam et al[46]
Postmenopausal bleeding	627.1	Eyre et al[9]	N95.0	Eyre et al[9]; Hogan et al[44]; Karam et al[46]
Premature ovarian failure/premature menopause	256.3	Eyre et al[9]	—	—
Premenopause	—	—	N92.4	Eyre et al[9]; Hogan et al[44]
Symptomatic menopausal/female climacteric state (vasomotor symptoms)	627.2	Blanken et al[42]; Eyre et al[9]; Gibson et al[37]; Gibson et al[38]; Gibson et al[39]; Hogan et al[44]; Pham et al[43]	N95.1	Brevy et al[8]; Eyre et al[9]; Hogan et al[44]; Karam et al[46]
Symptomatic postprocedural ovarian failure	—	—	E89.41	Karam et al[46]
Symptomatic premature menopause	—	—	E28.310	Karam et al[46]
Unspecified menopausal and perimenopausal disorders	627.9	Blanken et al[42]; Eyre et al[9]; Gibson et al[37]; Gibson et al[38]; Gibson et al[39]; Hogan et al[44]; Pham et al[43]	N95.9	Karam et al[46]
Urinary symptoms (nonspecific)	788.x	Gibson et al[37]; Blanken et al[42]	—	—

"Genitourinary syndrome of menopause (GSM)" is a contemporary clinical term; however, no distinct ICD-9 or ICD-10 diagnostic code exists. Coding in included studies relied on legacy terminology such as "postmenopausal atrophic vaginitis" or "other specified menopausal and perimenopausal disorders".

TABLE 4. Theme and subthemes across studies

Subthemes	Illustrative example	Citations
Primary Theme: Documentation Limitations—limitations in how menopause status and symptoms are structured, classified, temporally anchored, or interoperable in the EHR		
Absence of structured menopause-specific data fields	Lack of discrete EHR fields for reproductive milestones (eg, menopause, menarche), requiring algorithmic inference rather than direct capture.	Malinowski et al[32]
	Demonstrates that key menopause indicators (eg, last menstrual period) exist only in unstructured clinical notes, necessitating NLP for identification.	Eyre et al[9]
	Case definition development required integration of ICD codes, medication data, and free-text features to identify problematic menopause in primary care EHR data.	Pham et al[43]
	Validated symptom data collected via questionnaires are not integrated into routine, interoperable EHR fields.	Ryu et al[41]
	Used a structured electronic menopausal health screening and counseling platform (not embedded in EHR); significantly improved symptom tracking and health behaviors	Lee et al[40]
Under-coding and narrative–structured data mismatch	Menopause status is treated as an implicit or assumed variable rather than a directly documented clinical state.	Sabanovic et al[35]
	Menopause-related ICD-10 diagnosis codes were under-documented in women with significant menopause symptom burden.	Karam et al[46]
	Proxy indicators, such as hormone therapy prescriptions, are used to infer menopause status in the absence of structured documentation.	Gibson et al[39]
Temporal and interoperability constraints	Temporal ambiguity in menopause onset due to reliance on diagnosis or treatment dates rather than biological timing, with limited portability across EHR systems.	Hogan et al[44]
	Patient-reported challenges in communicating menopause symptoms and the inadequacy of standard clinical documentation to capture symptom complexity.	Vande Loo et al[34]
Primary Theme: Undertreatment of Menopause—documented symptoms not followed by guideline-concordant management or treatment, often varying by care context or specialty.		
Under-coding and clinical invisibility in care	Approximately 58% of cases met documented guideline-based prescribing criteria, although key elements such as treatment indications or contraindications were frequently absent from the EHR documentation.	Cordasco et al[36]
	Despite documented bothersome symptoms, nearly 40% of women had no prescription therapy, and 13% had no treatment documented.	DePree et al[3]
	Despite patient-reported moderate to severe vasomotor symptoms, only a minority had symptoms documented in structured EHR fields and even fewer received hormone therapy or nonhormonal treatment.	Bevry et al[8]
	Disconnect between documented menopause symptoms and guideline-concordant management, menopause symptoms were present in clinical notes, but often did not trigger structured treatment pathways.	Shourav et al[45]
Poor alignment between guidelines and EHR workflows	Only 5% of midlife women veterans had documented menopause symptoms in the EHR despite known higher symptom prevalence, revealing substantial documentation and treatment disparities across racial/ethnic groups.	Blanken et al[42]
	Documented menopausal symptoms in the EHR were associated with significantly higher odds of long-term and high-risk opioid prescribing, demonstrating how structured menopause documentation can influence downstream treatment patterns.	Gibson et al[37]
Primary Theme: Underreporting of Symptoms—discrepancy between expected or patient-reported symptom burden and what appears in structured EHR or claims data		
Loss of symptom data in administrative and claims sources	Menopause symptoms were identified solely through ICD-9 claims codes (627.xx), capturing only women who sought care and received a diagnosis. The authors explicitly acknowledge that women with significant but undocumented symptoms were likely misclassified as controls, leading to conservative estimates of burden.	Kleinman et al[31]
	Exclusively on ICD-9 codes extracted from VA administrative EHR data to identify menopause symptoms and comorbidities—thus could be missing those not reported via these measures.	Gibson et al[38]
Data trapped in unstructured clinical text	EHR findings with higher prevalence reported in surveys and interviews, signaling systematic under-capture.	Sussman et al[33]

EHR, electronic health record; ICD, International Classification of Diseases; NLP, natural language processing; VA, Veterans Health Administration.

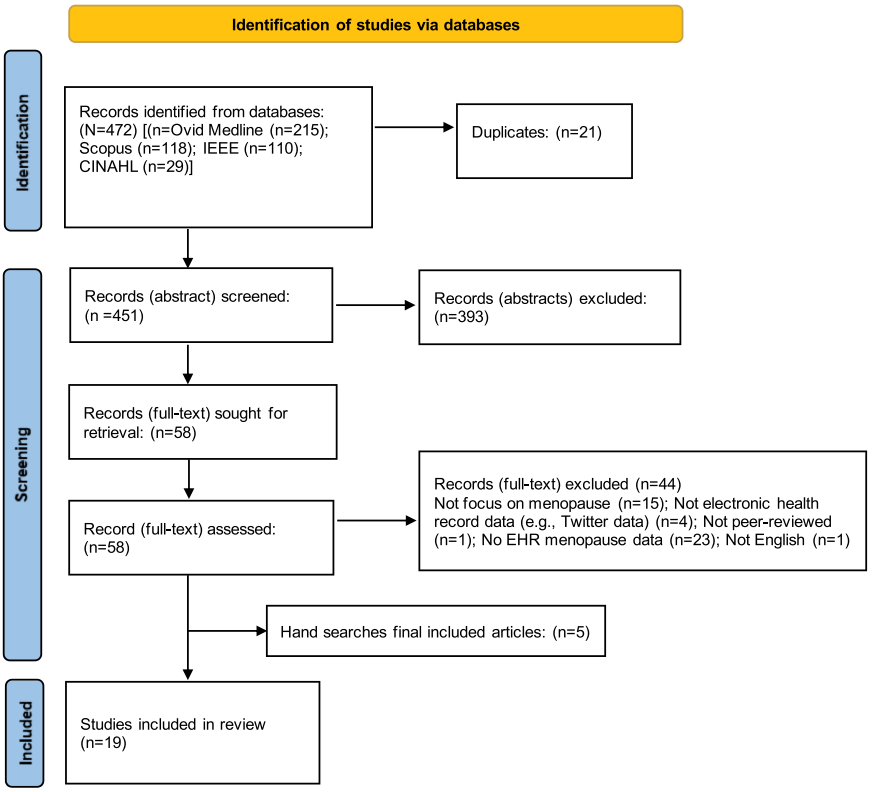

FIG. 1. PRISMA scoping review flow diagram. EHR, Electronic Health Record.

based or unclear reproductive stage definitions.[31,32] One study used self-reported reproductive stage assessment rather than EHR-structured staging.[33]

Representation of menopause in EHR data

A majority of studies used ICD-9 and ICD-10 codes. Other codes included SNOMED CT, Health Insurance Claim codes, and Mayo Problem Search Terminology codes. Only nine of the included studies provided specific codes used. Table 3 shows only the ICD-9 and ICD-10 codes.

Themes in menopause documentation and care

Included studies clustered into three primary themes: documentation limitations (n = 10), undertreatment of menopause (n = 6), and underreporting of symptoms (n = 3) (Table 4). Themes represent synthesis-level patterns identified across studies and are not intended as judgments of individual study quality or methodology. Each study was assigned to a single primary theme to ensure mutually exclusive categorization, with each theme comprising distinct yet interrelated subthemes reflecting structural documentation gaps, care delivery misalignment, and systematic symptom invisibility within EHR data.

DISCUSSION

This scoping review examined how menopause status and symptoms are represented, documented, and operationalized within electronic clinical information systems in health care settings. Across studies, menopause was most commonly identified using age-based criteria, diagnostic codes, or proxy indicators rather than structured reproductive stage documentation. These approaches revealed substantial variability in how menopause-related data are captured, coded, and operationalized. Through thematic analysis, we identified three interconnected patterns, documentation limitations, undertreatment, and underreporting, that collectively highlight a foundational informatics gap in the clinical representation of menopause. Most included studies used retrospective or cross-sectional EHR-based designs, consistent with the current reliance on observational clinical data in menopause research. However, despite advances from longitudinal cohort studies in characterizing menopause transitions, validated symptom scales and reproductive stage assessments have not been routinely incorporated into structured EHR workflows.

Future research should examine integrating standardized menopause symptom instruments and reproductive stage assessments (eg, STRAW+10) into structured clinical workflows, such as flowsheets, intake questionnaires, or nursing assessment tools, to support longitudinal symptom tracking within routine care.[6,47] Such integration could improve data quality, continuity of care, and the alignment of clinical documentation with research measurement.

A substantial proportion (7/19) of included studies were conducted within the Veterans Health Administration, which historically utilized a unified EHR platform (CPRS/VistA) across facilities.[9,36-39,44] This shared infrastructure may facilitate more consistent documentation and multisite data aggregation. In the United States, multiple EHR vendors and local customization can introduce additional documentation variability. Similarly, integrated health systems such as the Mayo Clinic and national health systems outside the United States may benefit from greater internal standardization. In contrast, fragmented public and private health systems may face greater challenges in harmonizing menopause-related data beyond reliance on diagnostic coding structures.[45,46,48]

The use of heterogeneous age ranges (eg, 45-60 vs. 35-65) to define menopausal populations underscores the absence of consensus cohort criteria in EHR-based research. Age alone is an imprecise proxy for reproductive stage and may obscure meaningful differences in symptom patterns and health risks across the menopause transition.[49] Without standardized staging definitions, multisite analyses risk combining biologically distinct phases under a single "menopause" label, introducing misclassification that limits comparability and longitudinal inference.

Similarly, reliance on ICD-9 and ICD-10 diagnostic codes provides limited specificity for menopause-related experiences. The small number of menopause-specific codes and variation across coding versions constrain accurate documentation of symptom type, severity, and reproductive stage.[46] In some cases, menopause was inferred using procedural and billing codes; for example, one identified menopausal women using ICD codes for abnormal uterine bleeding and CPT codes for endometrial biopsy among women aged 40 and older, with concurrent hormone therapy prescriptions.[36] However, abnormal uterine bleeding and endometrial biopsy are not specific to menopause and may reflect diverse gynecologic conditions.[36] Such proxy-based classification illustrates the challenges of relying on age and procedural codes to define reproductive stage within EHR data, potentially limiting care coordination, treatment evaluation, and the reliability of real-world evidence. In addition, although the term "genitourinary syndrome of menopause" has replaced "postmenopausal atrophic vaginitis" in clinical consensus statements, ICD-9 and ICD-10 coding systems retain legacy terminology (627.3; N95.2), and no distinct genitourinary syndrome of menopause diagnostic code exists. This misalignment between contemporary clinical language and billing-based coding structures may contribute to fragmented documentation and underrepresentation of genitourinary symptoms in EHR-derived datasets.

The theme of "documentation limitations," the most prevalent across studies, reflects recurring structural patterns identified across the literature rather than isolated documentation behaviors. Across studies, menopause status was commonly identified using age thresholds, diagnostic codes, or hormone therapy prescriptions instead of structured reproductive stage documentation.[9,34,39,41,43] Few studies differentiated perimenopause from postmenopause, and key elements such as last menstrual period (LMP), FMP, or menopause type were rarely available as extractable data fields, limiting alignment with staging frameworks such as STRAW+10. Although LMP is often documented in narrative notes, it is seldom structured for longitudinal analysis.

While emerging approaches such as NLP and AI-assisted abstraction demonstrate the ability to extract menopause-related information from free text, reliance on retrospective text mining underscores the absence of standardized structured fields and may limit scalability and interoperability.[9,19] Similarly, validated symptom instruments, such as the Menopause Rating Scale, Menopause-Specific Quality of Life, and Greene Climacteric Scale, exist but are not routinely embedded into EHR workflows or mapped to standardized terminology (ie, SNOMED CT or ICD).[10,11,50] Integrating such tools into structured flowsheets or intake assessments could enable longitudinal symptom tracking and improve clinical-research alignment. Algorithm validation studies[43] and electronic screening platforms[40] illustrate feasible methodological steps toward more reproducible case definitions and structured menopause data capture, providing a foundation for the development of standardized menopause common data elements.

The theme of "undertreatment" demonstrates how structural documentation gaps translate into clinical consequences. Even when vasomotor or other menopause symptoms were recorded, guideline-concordant management was inconsistent.[36,42] For example, some studies reported moderate to severe symptoms were sometimes documented without corresponding therapy initiation or follow-up, and hormone therapy prescribing studies revealed incomplete documentation of indications or contraindications.[3,8,45] When menopause is not systematically structured within clinical workflows, symptom documentation may not reliably trigger evidence-based care pathways.[51]

The theme of "underreporting" highlights additional loss of symptom information at the point of data capture. Studies relied exclusively on administrative or claims codes, capturing only women who sought care and received a diagnosis, while others required manual abstraction or NLP to identify symptoms documented in narrative notes.[9,19,31,38] Sensitive concerns, including sexual dysfunction or genitourinary symptoms, were particularly vulnerable to discretionary documentation.[33] Together, these patterns suggest that menopause symptom prevalence in EHR-derived datasets likely underestimates true clinical burden, limiting quality measurement and population-level surveillance.[46]

Contributions and implications

This scoping review demonstrates that menopause remains structurally underrepresented within EHR data

systems. Across studies, there was variation in how menopause was coded, frequently inferred from proxy indicators such as age, and often captured only in unstructured text.[9,32,35,42] These structural limitations constrain accurate symptom recognition, longitudinal tracking, and guideline-concordant management, while contributing to incomplete real-world evidence.

Improving menopause care requires upstream data infrastructure solutions rather than downstream analytic corrections. Development of a minimum viable set of structured menopause common data elements, including reproductive stage, FMP, symptom type and severity, and treatment status, would strengthen documentation, improve interoperability across systems, and support reliable longitudinal research.[52]

From clinical and policy perspectives, advancing menopause documentation will require multidisciplinary collaboration and alignment between evidence-based guidelines, EHR workflows, and national certification standards.[53] Incorporating structured menopause fields into certified EHR systems could enhance continuity of care, support systematic symptom assessment, and generate higher-quality real-world data to inform treatment decisions and equitable women's health research.[8]

Limitations

This scoping review has several limitations. We included only English-language articles published within the past 20 years, which may have excluded relevant studies in other languages or earlier foundational work. The selected time frame was intended to reflect the period of widespread EHR adoption; however, documentation practices may have evolved over time. As with any scoping review, synthesis and thematic interpretation were conducted by the authors and may be subject to interpretive bias, despite expertise in informatics, women's health, and primary care. One author (C.J.B.) contributed to several included studies, which presents a potential conflict of interest. To mitigate this risk, study selection and thematic decisions were reviewed independently by an additional investigator not involved in those studies. Strengths of this review include systematic screening, independent data extraction, and interdisciplinary expertise (ie, informatics, menopause, women's health, and primary care) guiding analysis, which enhance the rigor and credibility of the findings. Although several included studies demonstrated discordance between symptom burden, diagnostic coding, and treatment documentation, the overall magnitude of undocumented or undertreated menopause-related symptoms could not be consistently quantified across systems. Substantial heterogeneity in study design, population definitions, reproductive stage classification, symptom measurement methods, and coding strategies precluded pooled estimates or cross-study comparisons. This variability reflects a broader informatics limitation: without standardized reproductive stage fields, symptom instruments, and menopause-specific common data elements, reliable system-level estimates of documentation gaps cannot be generated. Future research using harmonized definitions and structured data capture will be necessary to more precisely quantify the scope of this problem. Future work may also explore the use of AI-assisted thematic analysis approaches to compare and validate recurring documentation patterns identified across menopause informatics studies.

CONCLUSION

This scoping review demonstrates that menopause remains inconsistently structured within EHR systems, limiting longitudinal tracking, clinical decision-making, and research reproducibility. Despite the growing attention to midlife women's health, standardized documentation of menopause status, reproductive stage, and symptom burden is not routinely embedded in clinical workflows. Advancing menopause care will require coordinated collaboration to implement menopause-specific common data elements within EHR systems to improve care quality, research scalability, and health outcomes for midlife women.

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